



Annual Reports :: Year 6 :: Pennsylvania State University

Project Report: GEOPULSE

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Project Progress

This last year saw significant progress on several related projects. We published a paper in Geobiology that uses genomics to deduce that sulfur–reduction is the most plausible early metabolism for the Archaea. We also published a paper on the microbial ecosystem at methane seeps in Eel River Basin. Also, in collaboration with the Rhode Island group, we have submitted two manuscripts related to the marine subsurface biosphere.

Highlights

- Using whole genomic analysis, we have published a paper showing that sulfur reduction is the most geologically plausible for the base of the Archaea.
- Using fluorescence in situ hybridization–secondary ion mass spectrometry (FISH–SIMS), we have found that archaeal cells near the zone of anaerobic methane oxidation in sediments of the Peru margin are not significantly ^{13}C –depleted.

Roadmap Objectives

- **Objective No. 4.1:** Earth's early biosphere
- **Objective No. 5.2:** Co–evolution of microbial communities
- **Objective No. 5.3:** Biochemical adaptation to extreme environments
- **Objective No. 7.2:** Biosignatures to be sought in nearby planetary systems

Mission Involvement

<i>Mission Class*</i>	<i>Mission Name (for class 1 or 2) OR Concept (for class 3)</i>	<i>Type of Involvement**</i>
3	Biomarkers and life detection	Background Research

* Mission Class: Select 1 of 3 Mission Class types below to classify your project:

1. Now flying OR Funded & in development (e.g., Mars Odyssey, MER 2003, Kepler)
2. Named mission under study / in development, but not yet funded (e.g., TPF, Mars Lander 2009)
3. Long-lead future mission / societal issues (e.g., far-future Mars or Europa, biomarkers, life definition)

** Type of Involvement = Role / Relationship with Mission

Specify one (or more) of the following: PI, Co-I, Science Team member, planning support, data analysis, background research, instrument/payload development, research or analysis techniques, other (specify).

These projects aim to understand microbial ecosystems and the impact they have on geochemistry. The results are useful in evaluating biomarkers and other methods for life detection.

Cross Team Collaborations

This project has two papers submitted that are collaborations with the Rhode Island astrobiology group related to the subsurface biosphere. Also, this last year, we published a paper with Victoria Orphan, who is part of the NASA Ames group.